BUILDING INVENTORY AND ENERGY USE SURVEY 1983

PREPARED FOR

Remote Community Demonstration Program

Energy, Mines and Resources Canada

PREPARE POUR

Le Programme de démonstration dans les collectivités éloignées

Energie, Mines et Ressources Canada

BY

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EXECUTIVE SUMMARY

This 1983 Building Inventory and Energy Use Survey (BIEUS) is a follow-on from the 1982 exercise. Collectively, the gathered data covers the Mackenzie River Communities up to the treeline.

The major recommendation of the 1983 exercise is as follows:

- that a more aggressive use of the renewable wood energy around communities is feasible and desirable from both an energy dollar saving and a socio-economic development point of view.

The means that should allow this to happen are principally as follows:

- that for all rented and leased buildings a gradually phased-in user-pay-to-market-price scheme should prevail to encourage each building user to find his/her lowest cost energy source.

- that proper firewood harvesting (consisting of cutting and drying cycles) and land use management schemes be created for each community south of the treeline.

The potential beneficial effects are:

- considerable dollar savings in fuel oils (estimated to be in the range of $2.4 to $6.4 million).

- an increased degree of community self-sufficiency based on a local resource.

- opportunities for community employment and local businesses to provide fuel wood management and product-handling services.

The 1983 survey was done under the Remote Community Demonstration Programme of Energy, Mines and Resources, Canada.

Communities of the NWT

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CHAPTER 1 - INTRODUCTION AND BACKGROUND TO STUDY

The Federal Department of Energy, Mines and Resources, through the Conservation and Renewable Energy Offices, has been seeking ways and means of reducing Canada's dependence on oil.

The Building Inventory and Energy Use Study (BIEUS) of 1983 (for the communities of Fort Norman, Fort Good Hope, Fort Franklin, Norman Wells, Arctic Red River, Fort McPherson, Aklavik, Colville Lake, Inuvik and Hay River) was instituted as a follow-on to an identical study done in the Southern Mackenzie area during the summer of 1982. In sum, the data generated in the two studies could give a very good notion of energy use types in the Mackenzie area communities, south of the treeline. Until these and other studies were undertaken, there was only broadly documented knowledge about energy form alternatives being consumed in these N.W.T. communities. Administrators intuitively knew that considerable amounts of expensive oil-based energy were being consumed because of the relative ease of acquisition of fuel oil through various government programmes and because some level of effort would be required on the part of the end-user to harvest alternative forms of energy.

The convenience of having cheap, readily available oil-based energy delivered to the end-consumer at little or no cost (often absorbed by the government sector building owner) had the unfortunate effect of building a dependence on heating oil in the North, paralleling the dependence of the southern city consumer on automotive fuel.

The two BIEUS (1982 and 1983) studies give an image (by community) of the types of ownership and the types of energy-use evident in the forested areas of the Western Arctic. In the 1983 computerized data base there is physical data for each of the 3,000 buildings of the 10 communities, which could be further manipulated for more refined conclusions. Coupled with broader community quantity surveys of energy use (the 1981 Science Advisory Board Study; the 1983 N.W.T. Energy Data Gathering Study), the solutions towards optimizing space-heating energy use in the N.W.T. and lessening dependence on expensive oil-based fuels should become more evident.

The survey portion of the BIEUS '83 Study consisted of examining approximately 3,000 buildings in 9 communities of the Lower Mackenzie River plus Hay River. Each building was examined for ownership, fuel type, building function, condition, physical dimensions, age, etc.. The reader can see a copy of the field survey form in Appendix A.

CHAPTER 2 - COMMUNITY BUILDING UNITS BY OWNERSHIP

Table A lays out the number of buildings observed in the 9 specified communities of the Lower Mackenzie and Hay River by ownership categories. The ownership categories are grouped into broader categories for government, business and privately held units and expressed as percentages of the total community stock. A basic thesis of this study is that ownership of a building and its consequent management largely determine the type (and influence the quantity) of energy used.

Table A also shows that almost half the buildings of the study communities are owned directly by government (including Social and Staff housing, as well as operational buildings). In any given community, government ownership of buildings could rise as high as 75% (Aklavik). In contrast to this, business owned buildings averaged a little less than one-quarter of all structures. The privately-owned building stock represented roughly one-third of the total building stock of the communities, although this could range - by community - from a low of approximately 9% (Norman Wells) to nearly 50% (Hay River). Further research would have to determine what portion of these privately held units are occupied by their owners.

TABLE A

COMMUNITY BUILDING UNITS BY OWNERSHIP AND OWNERSHIP GROUPING

COMMUNITY NUMBER	COMMUNITY NAME	NWTHC A	TERR. B	FEDERAL C	CROWN CORPS D	COMMUNITY G	GOVERNMENT PERCENTAGE	INDUSTRY E	COMMERCIAL F	BUSINESS PERCENTAGE	PRIVATE H	PRIVATE PERCENTAGE	TOTAL NUMBER
400	INUVIK	76	99	134	22	16	46.27	0	228	30.40	175	23.33	750
401	AKLAVIK	133	28	6	12	8	75.10	0	17	6.83	45	18.07	249
402	FT.MCPHERSON	62	42	7	10	6	57.21	0	12	5.41	83	37.39	222
403	ARCTIC RED RIVER	18	13	1	4	0	67.92	0	5	9.43	12	22.64	53
304	COLVILLE LAKE	0	0	1	1	0	5.41	0	17	45.95	18	48.65	37
302	FT. GOOD HOPE	28	34	6	12	2	48.52	0	15	8.88	72	42.60	169
301	FORT NORMAN	41	23	5	5	4	60.47	0	15	11.63	36	27.91	129
303	FORT FRANKLIN	67	22	2	11	1	73.05	0	16	11.35	22	15.60	141
300	NORMAN WELLS	16	28	46	13	4	34.41	0	177	56.91	27	8.68	311
109	HAY RIVER	42	62	68	96	41	33.01	0	208	22.22	419	44.76	936
	TOTAL	483	351	276	186	82	45.98	0	710	23.69	909	30.33	2997

NWTHC = NORTHWEST TERRITORIES HOUSING CORPORATION
TERR. = TERRITORIAL DEPT. OF PUBLIC WORKS
FEDERAL = FEDERAL DEPT. OF PUBLIC WORKS
COMMUNITY= MUNICIPAL GOVERNMENT

CHAPTER 3 - ESTIMATED ANNUAL NON-RENEWABLE ENERGY CONSUMPTION LEVELS BY COMMUNITY

Table B displays estimates of the annual non-renewable energy consumption levels by community by fuel type. Availability by type is currently influenced by transportation modes and the geographic location of production points.

For the most part, the estimates are a composite of interview results with local distributors or with Government of the Northwest Territories Petroleum, Oil and Lubricants Division. The recent Science Advisory Board report was also used as a source where local interviews or correspondence could not clarify volumes.

TABLE B

NON-RENEWABLE FUEL TYPES, THEIR USE BY COMMUNITIES & TRANSPORTATION MODES

COMMUNITY	FUEL OIL(L)	NATURAL GAS(CF)	PROPANE (L)	COAL(TONS)	ELECTRICITY GENERATION OIL IN LITRES	HEATING OIL (LITRES) TANKAGE	NORMAL FUEL TRANSPORTAION MODE ROAD	WATER	AIR	OTHER
AKLAVIK *	1615844	0	0	0	579897	-	W	X	-	-
INUVIK *	5533483	0	0	0	1909979	-	-	X	-	-
FT.MCPHERSON	1290954	0	0	0	673431	2831733	X	X	-	-
ARCTIC RED	149559	0	0	0	117169	497332	X	X	-	-
COLVILLE LAKE	4909	0	0	0	0	91903	-	-	X	-
FT.GOOD HOPE	1008955	0	0	0	253103	1036455	-	X	-	-
NORMAN WELLS	0	54412	0	0	887797	-	-	-	-	P
FT.FRANKLIN	1163120	0	0	0	497923	2163070	W	-	-	-
FT.NORMAN	1392724	0	0	0	270810	2723008	-	X	-	-
HAY RIVER *	8907922	0	7121900	0	6831068	-	-	-	-	R
TOTAL	21067470	54412	7121900	0	12021177	9343501				

*= SOURCED FROM 1981 G.N.W.T. SCIENCE ADVISORY BOARD STUDY 1980
W= WINTER ROAD
P= PIPELINE
R= RAIL

CHAPTER 4 - CONSOLIDATED TABLE OF OWNERSHIP BY FUEL TYPE FOR ALL STUDY COMMUNITIES

Table C is a consolidated (for all BIEUS '83 communities) table of Ownership by Fuel Type, also arranged in ownership groupings.

This table demonstrates the pronounced use of fuel oil (1,652 or 55% of a total 2,997 units) among the various energy alternatives. Of these oil-heated buildings, 52% were government owned and controlled. The next most popular energy types for space heating were utilidor (at 12.2%) and wood (at 8.6%).

On the other hand, it would seem that there is a distinct tendency for privately owned buildings to be heated with alternative fuels (88% of all wood heated buildings are privately owned, and 49% of all propane fueled buildings are privately held).

These figures would support the notion that those who are more directly accountable for their own energy use will tend to seek the lower cost energy type alternative.

TABLE C

ALL COMMUNITIES BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE / LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	WOOD & PROPANE	UTILIDOR & WOOD	NAT.GAS & WOOD	OIL & NAT.GAS	UNHEATED I	UTILIDOR I	TOTAL
BUILDING OWNERSHIP															
N.W.T.HOUSING CORP.-A	409	0	6	0	4	0	0	1	0	0	0	0	7	56	483
TERRITORIAL GOV'T-B	201	0	6	8	24	0	0	1	0	0	0	0	46	65	351
FEDERAL GOV'T-C	108	0	1	1	35	0	0	6	0	0	0	0	13	112	276
CROWN CORPORATIONS-D	113	0	1	28	10	0	0	6	0	0	0	0	18	10	186
COMMUNITY-G	34	0	1	3	3	0	0	2	29	0	0	0	5	5	82
SUB-TOTAL GOV'T	865	0	15	40	76	0	0	16	29	0	0	0	89	248	1378
PERCENTAGE GOV'T	52.36	.00	5.81	23.39	37.44	.00	.00	12.60	96.67	.00	.00	.00	50.57	67.76	45.98
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	366	5	16	47	120	0	1	23	1	0	4	1	53	73	710
SUB-TOTAL BUSINESS	366	5	16	47	120	0	1	23	1	0	4	1	53	73	710
PERCENTAGE BUSINESS	22.15	100.00	6.20	27.49	59.11	.00	100.00	18.11	3.33	.00	100.00	100.00	30.11	19.95	23.69
PRIVATE-H	421	0	227	84	7	0	0	88	0	3	0	0	34	45	909
PERCENTAGE PRIVATE	25.48	.00	87.98	49.12	3.45	.00	.00	69.29	.00	100.00	.00	.00	19.32	12.30	30.33
TOTAL	1652	5	258	171	203	0	1	127	30	3	4	1	176	366	2997

CHAPTER 5 - THE 1983 BIEUS COMMUNITIES

Tables D through M illustrate the Ownership and Fuel Type relationship for the ten communities researched during the 1983 season.

For example, in Table D for Fort Norman, one can see that 75% of all units (97 of 129 units) are burning fuel oil, with 70 of these units being under government control.

Each Table can be examined for the specific information picked up during the BIEUS '83 Survey; collectively they constitute the information found in Table C.

FORT NORMAN

FORT NORMAN

The Fort Norman site has long been of seasonal importance to the Slavey Dene. The Northwest Company was active in the area in the late 1700's and a Post was founded at Fort Norman in 1810.

The strategic location at the junction of the Mackenzie and Great Bear Rivers made it a transportation centre from the days of Franklin's explorations in the Great Bear region, to the pitchblende discoveries of the 1920's, and into the modern era.

The Dene of Fort Norman carry on the trapping life today, supplemented by employment at the Norman Wells oilfield. One notable feature of the community is the Anglican Church, built of squared logs in the 1860's and recently restored by the community.

LOCATION: 64° 54'N, 125° 34'W

POPULATION: 285

TABLE D

FORT NORMAN BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOODOIL G	& WOOD H	UNHEATED I	TOTAL
BUILDING OWNERSHIP										
N.W.T.HOUSING CORP.-A	40	0	0	0	0	0	0	0	1	41
TERRITORIAL GOV'T-B	18	0	1	0	0	0	0	0	4	23
FEDERAL GOV'T-C	4	0	1	0	0	0	0	0	0	5
CROWN CORPORATIONS-D	4	0	0	0	0	0	0	0	1	5
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	10	0	2	1	0	0	0	0	2	15
COMMUNITY-G	4	0	0	0	0	0	0	0	0	4
PRIVATE-H	17	0	19	0	0	0	0	0	0	36
TOTAL	97	0	23	1	0	0	0	0	8	129

FORT GOOD HOPE

FORT GOOD HOPE

Fort Good Hope was the oldest fur trading post in the Lower Mackenzie, having been established by the Northwest Company in 1805. After the amalgamation of the Hudson's Bay and Northwest Companies in 1821, the post was relocated several times but returned in 1836-39 to its original site. The presence of the post stimulated an extensive trade network extending north to Herschel Island and west to Russian Alaska.

In 1859 Father Grollier built a mission near Fort Good Hope. Six years later, Father Emile Pettitot arrived and during his stay the present church was built. In 1878 Pettitot began painting the murals which decorate the interior of the church.

By 1931 an Indian Agent was appointed and there was an influx of newcomers attributable to the oil finds at Norman Wells, 144 km away. Trapping continues to be a major source of income for the Hareskin Dene inhabitants. During the Berger Inquiry of 1975, they were noted for their vocal opposition to the construction of a Mackenzie Valley pipeline before land claims are settled.

LOCATION: 66° 15'N, 128° 38'W

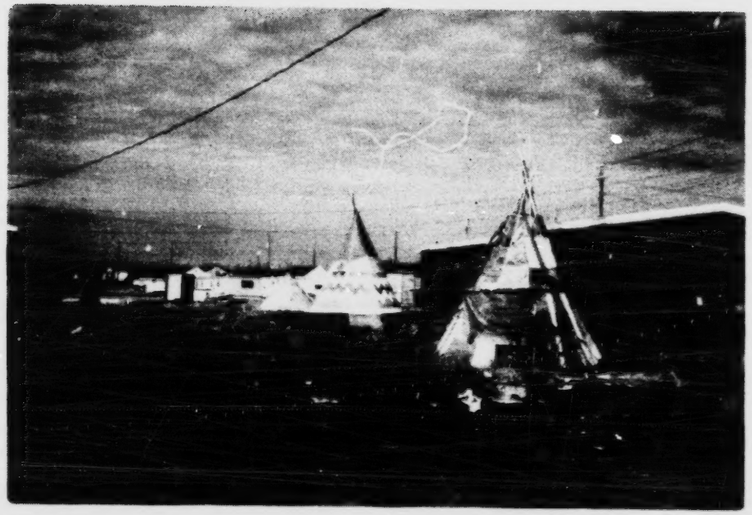
POPULATION: 455

TABLE E

FORT GOOD HOPE BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	MAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	TOTAL
BUILDING OWNERSHIP										
N.W.T.HOUSING CORP.-A	27	0	1	0	0	0	0	0	0	28
TERRITORIAL GOV'T-B	25	0	4	0	0	0	0	0	5	34
FEDERAL GOV'T-C	5	0	0	0	0	0	0	0	1	6
CROWN CORPORATIONS-D	8	0	0	0	0	0	0	0	4	12
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	12	0	0	1	0	0	0	0	2	15
COMMUNITY-G	1	0	1	0	0	0	0	0	0	2
PRIVATE-H	11	0	58	0	0	0	0	0	3	72
TOTAL	89	0	64	1	0	0	0	0	15	169

FORT FRANKLIN



FORT FRANKLIN

Fort Franklin is a Hareskin Dene community, named after Sir John Franklin, who occupied the Fort as his winter headquarters in 1825-27, during his second expedition to the area. The site had been a Northwest Company trading post and the Hudson's Bay Company re-opened it to supply the Franklin party.

This occupation was not permanent, however. A number of trading post licences were issued for Fort Franklin in the early 1900's and, with the discovery of pitchblende at Port Radium and oil at Norman Wells in the 1920's, Great Bear Lake and River became important transportation routes.

By 1945-50, Fort Franklin became more settled with the establishment of a Roman Catholic mission, a day school and the re-opening of a Hudson's Bay post. During the last twenty years, more and more families have started living at Fort Franklin year round.

LOCATION: 65^{o} 10'N, 123^{o} 25'W

POPULATION: 520

TABLE F

FORT FRANKLIN BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	TOTAL
BUILDING OWNERSHIP										
N.W.T.HOUSING CORP.-A	63	0	4	0	0	0	0	0	0	67
TERRITORIAL GOV'T-B	21	0	0	0	0	0	0	0	1	22
FEDERAL GOV'T-C	2	0	0	0	0	0	0	0	0	2
CROWN CORPORATIONS-D	11	0	0	0	0	0	0	0	0	11
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	14	0	0	0	0	0	0	1	1	16
COMMUNITY-G	1	0	0	0	0	0	0	0	0	1
PRIVATE-H	4	0	18	0	0	0	0	0	0	22
TOTAL	116	0	22	0	0	0	0	1	2	141

NORMAN WELLS

NORMAN WELLS

Norman Wells was the first community in the N.W.T. to be established entirely as a result of non-renewable resource development.

Oil seepages were investigated at the site in 1911, and by 1918 three leases which had been staked in 1914 at the mouth of Bosworth Creek, were acquired by a subsidiary of Imperial Oil, the Northwest Company. The discovery well was drilled in 1919 and oil encountered in commercial quantities at 239 m..

A small refinery was built in the early 1920's, but until 1933 the local market for gasoline and diesel fuels was negligible. The development of the Port Radium pitchblende deposits created a major new demand, and further industrial needs were established at Yellowknife from 1937 on, leading Imperial Oil to construct a new refinery capable of producing a wider variety of petroleum products in 1939 and to drill wells to a total of four.

After the war, when the Canol pipeline was constructed and then abandoned, the operation was governed by the rate of expansion of the mining industry and related activities in the Mackenzie District. Today, over a million barrels per year of crude oil are produced at Norman Wells. The settlement is a major transportation centre for air and river traffic and the supplier of fuel to communities further north.

LOCATION: 65^{o} 17'N, 126^{o} 50'W

POPULATION: 420

TABLE 6

NORMAN WELLS BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	WOOD & NAT.GAS	OIL & NAT.GAS	TOTAL
BUILDING OWNERSHIP												
N.W.T.HOUSING CORP.-A	12	0	0	0	4	0	0	0	0	0	0	16
TERRITORIAL GOV'T-B	3	0	0	1	24	0	0	0	0	0	0	28
FEDERAL GOV'T-C	6	0	0	0	35	0	0	5	0	0	0	46
CROWN CORPORATIONS-D	0	0	0	0	10	0	0	3	0	0	0	13
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	38	5	0	0	120	0	1	8	0	4	1	177
COMMUNITY-G	0	0	0	0	3	0	0	1	0	0	0	4
PRIVATE-H	20	0	0	0	7	0	0	0	0	0	0	27
TOTAL	79	5	0	1	203	0	1	17	0	4	1	311

ARCTIC RED RIVER

ARCTIC RED RIVER

It is probable that Arctic Red River, sited at the confluence of two rivers, was a seasonal fishing camp of the Loucheux Dene for many centuries prior to European contact. Alexander Mackenzie's voyage in 1789 on the river that bears his name, opened the area to trade and evangelization. Members of the Fort McPherson Loucheux band who had converted to the Roman Catholic faith were drawn to Arctic Red River when a mission was established there in 1868. The Hudson's Bay Company opened a trading post in the early 1870's.

As late as 1940, though, there were only three families living year round at Arctic Red River. Permanent occupation is quite recent and even in the 1960's the school was temporarily closed due to low attendance of children away on the trapline with their parents.

Construction of the Dempster Highway in the late 1970's offered wage employment near to home and, with a ferry crossing at the settlement, increased access to larger centres.

LOCATION: 67^{O} 27'N, 133^{O} 44'W

POPULATION: 120

TABLE H

ARCTIC RED RIVER BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	TOTAL
BUILDING OWNERSHIP										
N.W.T.HOUSING CORP.-A	15	0	1	0	0	0	0	0	2	18
TERRITORIAL GOV'T-B	9	0	1	0	0	0	0	0	3	13
FEDERAL GOV'T-C	1	0	0	0	0	0	0	0	0	1
CROWN CORPORATIONS-D	1	0	0	0	0	0	0	0	3	4
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	3	0	0	0	0	0	0	0	2	5
COMMUNITY-G	0	0	0	0	0	0	0	0	0	0
PRIVATE-H	5	0	3	0	0	0	0	0	4	12
TOTAL	34	0	5	0	0	0	0	0	14	53

FORT MC PHERSON

FORT McPHERSON

The Kutchin Dene band in the Fort McPherson area were known as Takudh-Kutchin, "people of the slanting eyes", which translates into "loucheux" in French, the name by which they are commonly known.

The Kutchin had already received iron spears and Russian trade goods via Alaska when they were encountered by Mackenzie about 1785. Sir John Franklin was in the area during his second expedition (1825-8) and advised the Hudson's Bay Company that the area was rich in furs. The first Hudson's Bay Company post was established on the Peel River in 1840 and in 1848 it was named after the chief trader of the Bay, Murdoch McPherson. In 1852 a Dene village on the bank of the Peel was moved to Fort McPherson. Between 1849 and 1859 there were frequent feuds between the Loucheux and neighbouring Inuit, and the new post afforded an excellent view of the Delta, with the advantage of an early warning of approaching enemy.

The Roman Catholic mission was established by Father Grollier, who baptised 65 people in 1860. This group subsequently moved to Arctic Red River, as an Anglican mission was also opened in 1860 and won the adherence of the remainder of the people.

In spite of several influenza epidemics which swept away large parts of the population in the early 20th century, the Loucheux maintained the independent bush lifestyle until well into the 1960's.

LOCATION: 67^{o} 26'N, 134^{o} 53'W

POPULATION: 625

TABLE I

FORT MCPHERSON BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	TOTAL
BUILDING OWNERSHIP										
N.W.T.HOUSING CORP.-A	62	0	0	0	0	0	0	0	0	62
TERRITORIAL GOV'T-B	29	0	0	0	0	0	0	0	13	42
FEDERAL GOV'T-C	4	0	0	0	0	0	0	0	3	7
CROWN CORPORATIONS-D	10	0	0	0	0	0	0	0	0	10
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	9	0	2	0	0	0	0	0	1	12
COMMUNITY-G	5	0	0	0	0	0	0	0	1	6
PRIVATE-H	25	0	52	0	0	0	0	0	6	83
TOTAL	144	0	54	0	0	0	0	0	24	222

AKLAVIK

AKLAVIK

Aklavik, which means "Place of the Barren Land Grizzly Bear" in Inuktitut, was the place where Inuvialuit and Loucheux Dene traditionally met and sometimes clashed in their search for food and furs. Small trading posts, including the Hudson's Bay, were established in the area by 1910-12, and by 1918 the permanent settlement of Aklavik was begun. Within ten years the settlement included an Anglican and a Catholic mission, the R.C.M.P. western arctic headquarters, and the relocated Bay store. On July 1st, 1929 the first plane landed at Aklavik and by the following December contract air mail service had begun.

By 1952 the population had expanded to about 1,556 and was comprised of Inuvialuit, Dene, Alaskan Inuit and other residents. Owing to serious flooding and erosion problems at the Aklavik site, the Federal Government decided to relocate the community 58 km. to the east. Inuvik was completed in 1961, but the move was only partially successful. Many residents preferred to remain at Aklavik and, while it is not the regional centre it once was, its inhabitants proudly call it "The Town That Wouldn't Die".

LOCATION: 68^{o} 13'N, 135^{o} 00'W

POPULATION: 705

TABLE J

AKLAVIK BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	TOTAL
BUILDING OWNERSHIP										
N.W.T.HOUSING CORP.-A	131	0	0	0	0	0	0	0	2	133
TERRITORIAL GOV'T-B	17	0	0	0	0	0	0	0	11	28
FEDERAL GOV'T-C	5	0	0	0	0	0	0	0	1	6
CROWN CORPORATIONS-D	7	0	0	0	0	0	0	0	5	12
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	14	0	0	0	0	0	0	0	3	17
COMMUNITY-G	6	0	0	0	0	0	0	0	2	8
PRIVATE-H	35	0	0	0	0	0	0	0	10	45
TOTAL	215	0	0	0	0	0	0	0	34	249

COLVILLE LAKE

COLVILLE LAKE

Father Emile Pettitot travelled extensively around the ancestral homeland of the Hareskin Dene in the latter part of the 19th century. He mapped the area as well as spreading the Gospel.

The settlement of Colville Lake was only organized in 1962 with the establishment of the Roman Catholic mission under the guidance of Father Bern Will Brown. The log church, "Our Lady of the Snows", has a one thousand pound bell.

Colville Lake is the only all-log community in the N.W.T. and its inhabitants pursue a seasonal landbased lifestyle.

LOCATION: 67° 02'N, 126° 07'W

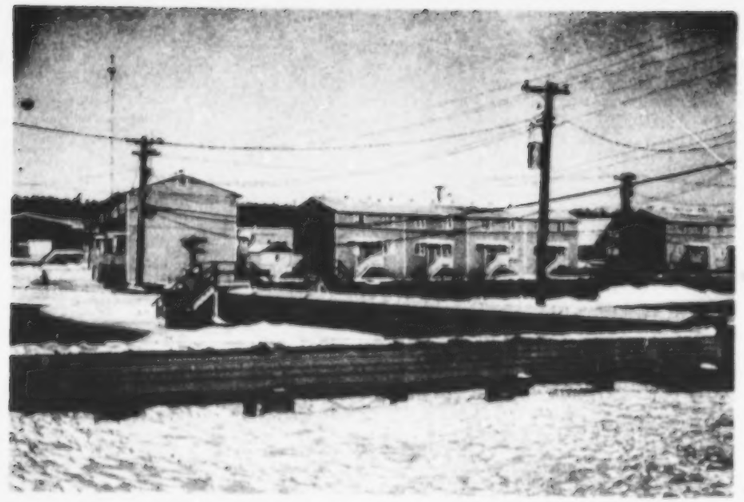
POPULATION: 55

TABLE K

COLVILLE LAKE BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	TOTAL
BUILDING OWNERSHIP										
N.W.T.HOUSING CORP.-A	0	0	0	0	0	0	0	0	0	0
TERRITORIAL GOV'T-B	0	0	0	0	0	0	0	0	0	0
FEDERAL GOV'T-C	1	0	0	0	0	0	0	0	0	1
CROWN CORPORATIONS-D	0	0	1	0	0	0	0	0	0	1
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	0	0	7	0	0	0	0	1	9	17
COMMUNITY-G	0	0	0	0	0	0	0	0	0	0
PRIVATE-H	0	0	18	0	0	0	0	0	0	18
TOTAL	1	0	26	0	0	0	0	1	9	37

INUVIK



INUVIK

The Inuvialuit and Dene traditionally hunted and fished in the region of Inuvik, and Alexander Mackenzie paddled by the present site as early as 1789 on his journey to the Arctic Ocean. However, the site of Inuvik was seldom visited until 1954. In that year the Federal Government decided to move the regional centre from Aklavik, because of problems of erosion and flooding, and to enlarge the school, hospital, airport and administration facilities at another site.

After extensive reconnaissance of the entire Mackenzie River Delta, the site of Inuvik was chosen and construction begun in 1955, continuing until 1961. By that year, there was a diesel electric generating system, a school, a bank, the post office, R.C.M.P. district headquarters, a radio station and a new hospital.

Inuvik is the largest Canadian community north of the Arctic Circle and the N.W.T.'s first modern planned town.

LOCATION: 68^{o} 21'N, 133^{o} 43'W

POPULATION: 3,125

TABLE L

INUVIK BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UTILIDOR & WOOD	UTILIDOR I	UNHEATED I	TOTAL
BUILDING OWNERSHIP												
N.W.T.HOUSING CORP.-A	18	0	0	0	0	0	0	0	0	56	2	76
TERRITORIAL GOV'T-B	25	0	0	0	0	0	0	1	0	65	8	99
FEDERAL GOV'T-C	16	0	0	0	0	0	0	0	0	112	6	134
CROWN CORPORATIONS-D	10	0	0	0	0	0	0	0	0	10	2	22
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	123	0	2	1	0	0	0	2	0	73	27	228
COMMUNITY-G	10	0	0	0	0	0	0	0	0	5	1	16
PRIVATE-H	101	0	7	0	0	0	0	8	3	45	11	175
TOTAL	303	0	9	1	0	0	0	11	3	366	57	750

HAY RIVER

HAY RIVER

The original site of Hay River is where the Dene village now stands. It appeared on maps as early as 1854, but the first permanent building - a Hudson's Bay post on the east bank of the river - was not constructed till 1868. In 1869 a Roman Catholic mission was founded but it was abandoned in 1875. An Anglican mission was established in 1893. The R.C.M.P. detachment was opened in 1925, and soon afterwards a hospital was added to the growing community on the east bank. By 1939 some settlement was begun on Vale Island and in 1942 the U.S. Corps of Engineers built an airstrip on the Island. With the building of the Mackenzie Highway from Hay River to Grimshaw in 1948, a new townsite was laid out on the west channel. The community became an important transportation and communications centre, as well as the centre of the Great Slave Lake commercial fishery.

Serious flooding in 1951 and 1963 on Vale Island requiring mass evacuation, has tended to concentrate development on the adjacent mainland. By 1964 a C.N.R. rail link with Alberta was established at Hay River. In spite of an economic boom in the late 1960's and early 1970's connected with oil and gas exploration, Hay River remains one of the few communities in the N.W.T. which is largely dependent on private enterprise.

LOCATION: 60^{o} 49'N, 115^{o} 47'W

POPULATION: 2,855

TABLE M

HAY RIVER BUILDINGS BY OWNERSHIP AND FUEL TYPE

FUEL TYPE LETTER DESIGNATION	OIL A	ELECTRIC B	WOOD C	PROPANE D	NAT.GAS E	ELEC.& OIL F	ELEC.& WOOD G	OIL & WOOD H	UNHEATED I	WOOD & PROPANE	TOTAL
BUILDING OWNERSHIP											
N.W.T.HOUSING CORP.-A	31	0	0	0	0	0	0	1	0	0	42
TERRITORIAL GOV'T-B	54	0	0	7	0	0	0	0	1	0	62
FEDERAL GOV'T-C	54	0	0	1	0	0	0	1	2	0	68
CROWN CORPORATIONS-D	62	0	0	28	0	0	0	3	3	0	96
INDUSTRIAL-E	0	0	0	0	0	0	0	0	0	0	0
COMMERCIAL-F	103	0	3	44	0	0	0	11	6	1	208
COMMUNITY-G	7	0	0	3	0	0	0	1	1	29	41
PRIVATE-H	203	0	52	84	0	0	0	80	0	0	419
TOTAL	514	0	55	167	0	0	0	97	13	30	936

CHAPTER 6 - AVAILABILITY OF WOOD FOR HEATING

Table N outlines the history of forest fires within the last eight years around the study communities, as compiled from the records of the DIAND Fire Centre in Fort Smith.

The reason for compiling this information is to ascertain the availability of "fire killed" wood in the immediate areas around the communities. People of the study communities who have burned wood as fuel have traditionally looked to these "fire killed" areas first as a source of seasoned wood, ready for use with little preparation. This practice has continued in spite of the additional effort needed to transport the wood greater distances than if wood fuel was taken from forest stands on the edges of the settlement.

Some DIAND forest managers suggest that there is probably an unlimited supply of renewable fuels for community use, if the resource were to be managed in a conventional well-organized sense with wood being cut and properly air-dried one season in advance of use. Utilizing such a harvesting/management scheme, plentiful green wood growing around the communities could be processed as the principal energy supply.

The cutting of local firewood surrounding each of the communities (presumably regulated by the municipalities in conjunction with GNWT Local Government's Town Planning and Lands Division or the Federal Lands Office) could have beneficial effects beyond the immediate saving of oil-based fuels. A firewood industry in each community could have the double advantage of providing an additional margin of forest fire security by cutting back the heavily forested areas immediately adjacent to the settlement, as well as providing a source of badly needed local employment. In addition, the movement away from oil to locally harvested wood would give Northern communities greater security of supply and autonomy from distant supply points in the coming years. It would help to sustain a local economy in the communities by circulating local money supply through one more cycle.

Table O converts the current oil consumption of communities to an estimated wood volume equivalent (where one cord of low density wood such as spruce or pine is

equal to 264 litres of fuel, or one cord of high density wood, such as maple, oak or hickory, is equal to 455 litres of fuel, and where one cord of wood is valued at $80) for each community. The only exception is Norman Wells, where it is assumed that natural gas is and will remain the dominant energy form. The purpose of creating the table is to estimate the physical quantity of wood needed to displace fuel oil as well as the approximate value of the wood. Tables O and Q consider oil alone and ignore the impact of energy use in propane and wood in Hay River.

In Table P a different approach is used to demonstrate a hypothetical 29,970 total cords of wood required by the 10 BIEUS '83 communities, assuming 10 cords per building unit average consumption, and the number of building units observed during the survey. To arrive at an approximate value of the wood, an assumed value of $80 per cord is also used.

Table Q contains estimated retail values for oil consumption levels presently being used in the communities. When compared to the hypothetical values calculated in Tables O and P for wood, one can see the substantial savings through the use of wood energy (not taking into account the cost of converting heating plants from other fuels to wood).

Collectively, Tables O, P and Q have been created to demonstrate a range of amount and value while using wood as a principal space heating fuel in the BIEUS '83 communities; to demonstrate the value of currently utilized fuel oil ($8.8 million); to demonstrate the potential range of savings that could result from displacing all space-heating oil to wood ($2.4 million, $5.1 million or $6.4 million depending upon assumptions).

TABLE N PAST FOREST FIRES NEAR BIEUS'83 COMMUNITIES *

COMMUNITY	MAP NUMBER	MAP NAME	YEAR OF FIRE	DISTANCE IN KMS.	DIRECTION	ROAD ACCESS	REMARKS
Fort McPherson	106M	Same	1982	20	E	no	spot
A.Red River	106N	Same	1982	12	NE	no	spot
	106N	Same	1982	20	NE	no	spot
Fort Good Hope	106I	Same	1982	45	W	no	spot, across river
Norman Wells	96E	Same	1980	2	E	?	spot
	96E	Same	1980	2	W	?	spot
	96E	Same	1980	5	NW	no	spot
	96E	Same	1980	7	NW	no	spot
	96E	Same	1980	25	W	no	spot, across river
	96E	Same	1982	25	NE	no	spot
	96E	Same	1982	24	N	no	spot
Fort Franklin	96G	Same	None in recent years		-	-	-
Fort Norman	96C	Same	1980	4	E	no	spot
	96C	Same	1980	5	SE	Seasonal?	spot, river island
	96C	Same	1980	10	SE	Seasonal?	spot, river island
	96C	Same	1982	10	SE	no	spot
Colville Lake	96N,96M	Lac Maunoir					
		Aubry Lake	1980	45	E	no	spot
		"	1982	30	NW	no	spot
Aklavik	107B	Same	1980	2	NW	?	spot
	107B	Same	1980	3	NW	no	spot
Inuvik	107B	Aklavik	1980	7	SE	no	spot
	107B	Aklavik	1980	4	N	no	spot
	107B	Aklavik	1982	0	-	yes	in town
Hay River	85D,85C	Buffalo Lake					
		Tathlina Lake	1981	20	S	yes	40 kms. by road
	85D,85C	"	1981	25-90	SW	Seasonal?	across river
	85D,85C	"	1981	0	-	yes?	Vale Island
	85D,85C	"	1981	8	SW	yes	spot
	85D,85C	"	1981	7	SE	no	small area
	85D,85C	"	1982	9	SE	no	spot

* Source: DIAND Forestry, Fort Smith Fire Center

TABLE O

ESTIMATED WOOD CONSUMPTIONS AND VALUES

COMMUNITY	HEATING FUEL OIL(L)	WOOD * EQUIVALENT (IN CORDS)	$COST PER CORD	TOTAL $VALUE	WOOD @ EQUIVALENT (IN CORDS)	$COST PER CORD	TOTAL $VALUE
AKLAVIK	1615844	6121	80	489650	3551	80	284104
INUVIK	5533483	20960	80	1676813	12162	80	972920
FT.MCPHERSON	1290954	4890	80	391198	2837	80	226981
ARCTIC RED	149559	567	80	45321	329	80	26296
COLVILLE LAKE	4909	19	80	1488	11	80	863
FT.GOOD HOPE	1008955	3822	80	305744	2217	80	177399
NORMAN WELLS	0	0	80	0	0	80	0
FT.FRANKLIN	1163120	4406	80	352461	2556	80	204505
FT.NORMAN	1392724	5275	80	422038	3061	80	244875
HAY RIVER	8907922	33742	80	2699370	19578	80	1566228
TOTAL	21067470	79801		6384082	46302		3704171

*= ONE CORD OF LOW DENSITY WOOD = 264 LITRES

@ = ONE CORD OF WOOD = 455 LITRES

TABLE P

WOOD VOLUMES & RETAIL VALUE BASED ON CORDS PER BUILDING

COMMUNITY	NUMBER OF BUILDINGS	CONSUMPTION (CORDS) PER UNIT	TOTAL CORDS	$COST PER CORD	TOTAL $VALUE
AKLAVIK	248	10	2480	80	198400
INUVIK	750	10	7500	80	600000
FT.MCPHERSON	222	10	2220	80	177600
ARCTIC RED	53	10	530	80	42400
COLVILLE LAKE	37	10	370	80	29600
FT.GOOD HOPE	169	10	1690	80	135200
NORMAN WELLS	311	10	3110	80	248800
FT.FRANKLIN	141	10	1410	80	112800
FT.NORMAN	129	10	1290	80	103200
HAY RIVER	937	10	9370	80	749600
AVERAGE		10		80	
TOTAL	2997		29970		2397600

TABLE Q

ESTIMATED OIL-BASED CURRENT COSTS & RETAIL VALUE

	HEATING FUEL OIL(L)	$COST PER LITRE	TOTAL $VALUE
AKLAVIK	1615844	.41	662496
INUVIK	5533483	.41	2268728
FT.MCPHER	1290954	.41	529291
ARCTIC RE	149559	.46	68797
COLVILLE	4909	.71	3485
FT.GOOD H	1008955	.43	433851
NORMAN WE	0	.41	0
FT.FRANKL	1163120	.51	593191
FT.NORMAN	1392724	.43	598871
HAY RIVER	8907922	.41	3652248
AVERAGE		.46	
TOTAL	21067470		8810959.

POTENTIAL $ SAVINGS IN DISPLACED OIL

GREATEST $ SAVINGS =6413359 WHEN 100 CORDS = 264 LITRES OF FUEL; SEE TABLE O
MEDIAN $ SAVINGS =5106788 WHEN 100 CORDS = 455 LITRES OF FUEL; SEE TABLE O
LOWEST $ SAVINGS =2426877 WHEN EACH BUILDING CONSUMES 10 CORDS OF WOOD ON AVERAGE; SEE TABLE P

CHAPTER 7 - GENERAL RECOMMENDATIONS WITH REGARD TO ENERGY CONSERVATION AND ALTERNATIVE RENEWABLE FUELS FOR SPACE HEATING

This Report recommends that governments (and their corporations) should encourage the expanded use of renewable fuels in housing and operational buildings, by gradually phasing in close-to-market energy prices and tenant accountability for actual energy used.

It is further recommended that more aggressive use of the abundant renewable energy sources around the communities be made by the management of wood stands surrounding all the BIEUS '83 communities (cutting, stacking and air drying for one season before use). This would probably best be managed through a land use management system administered directly by the community in conjunction with GNWT Local Government's Town Planning and Lands Division or the Federal Lands office, depending upon the existence and size of a Block Land Transfer area around a given community.

CHAPTER 8 - RECOMMENDATIONS TO COMMUNITIES WITH REGARD TO SPACE HEATING

It is recommended that communities move gradually away from an extensive reliance on petroleum based fuels to more readily available renewable energy sources, especially wood.

The first means of reducing reliance on petroleum based fuels in the western arctic south of the treeline should be the creation of a progressive energy accountability scheme (user-pay) at the building unit level. This would have the effect of giving the building occupant/manager the incentive to seek the lowest cost (consistent with the lifestyle skills of the occupant) energy source for space heating.

With present low income levels and high energy prices, it is desirable that this should not happen overnight to avoid the inevitable social stresses that come with sudden change. Rather, fuel energy prices at the building unit level should gradually rise to closer to free market prices, thereby giving increasing incentive to the northern resident to use some amount of alternative (initially, but not exclusively, wood) energy to lessen dependence upon expensive oil.

This would have the threefold effect of:

1. Producing considerable dollar savings in fuel oils (Tables O, P and Q indicate that these potentially could be in the order of 2.4 to 6.4 million dollars for the BIEUS '83 communities.

2. Producing an increased degree of energy self-sufficiency based upon a local resource for Mackenzie communities.

3. Perhaps most importantly, create an opportunity for some community employment and local businesses or Band Councils to provide wood harvesting/management labour and product handling services to meet community demand (estimated by community volumes in Tables O and P).

CHAPTER 9 - OPPORTUNITIES FOR FURTHER STUDY

While Tables D through M of this report give the detailed outline of the survey data, the computerized data base (currently stored with a Yellowknife time-sharing computer company) created through this study should serve to permit CREO-NWT (the Federal Conservation and Renewable Energy Office in the N.W.T.) to target effectively those who might be most likely to take advantage of E.M.R.'s current C.H.I.P. (Canadian Home Insulation Programme) and C.O.S.P. (Canadian Oil Substitution Programme) programmes (major ownership groups down to individual units).

For example, by initially selecting privately owned units in the BIEUS '83 data base currently using fuel oil for space heating and cross-referencing these unit numbers with community research maps and other records on file with the E.M.R. CREO office, it is possible to pinpoint the units which should have the most immediate incentive to use upgrading programmes like C.H.I.P. and C.O.S.P..

Combined with the identically formatted 1982 data base, it will be possible similarly to examine the whole of the building and energy use situation south of the treeline in the Mackenzie Valley. With good quality community information and additional information from the 1981 S.A.B. (Science Advisory Board) Energy Report and the 1983 G.N.W.T. (Government of the Northwest Territories) Energy Data System (due for completion in 1984), it should be possible to plan more effective programmes which will result in efficient community use of energy. It could also be instrumental in the designing of programmes which will help to achieve the national goal of reducing oil consumption; and suggesting ways to create badly needed employment in western arctic communities; and increasing community self-sufficiency with regard to energy supply.

Community groups could be approached with data and be shown the potential for new small business in the firewood energy field while lessening their dependence on "outside" supplies of oil. For those communities who were unwilling or unable to harvest sufficient supplies of wood, upstream communities of the southern Mackenzie should consider the possibilities of inter-settlement commerce in fuel wood.

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APPENDIX A

BUILDING INVENTORY AND ENERGY USE SURVEY

CODE # _____

A. 1. Region of community:
2. Name of community:

3. Location of building:

☐ a) address:
☐ b) lot #:

B. 4. Function:

☐ a) residential
☐ b) commercial
☐ c) community

C. 5. Ownership:

☐ a) N.W.T. Housing
☐ b) Government of the N.W.T.
☐ c) Public Works Canada
☐ d) Crown Corporations
- NCPC
- NTCL
- RCMP
- Canada Post
- N.W. Tel
- Other (specify) _____

☐ e) Industrial
- Cominco
- Giant
- Other (specify)

☐ f) Commercial
_____ (specify

☐ g) Community (specify)
_____

☐ h) Private

D. 6. Age of building:

☐ a) before Sept. 1977
☐ b) before Oct. 1980
☐ c) after Oct. 1980
☐ d) specify if possible _____

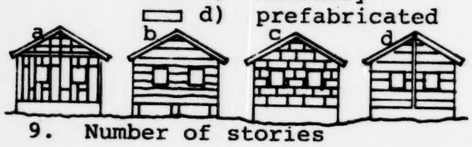
7. Type of building:

☐ a) single detached
☐ b) duplex
☐ c) multiple (up to four)
☐ d) row housing - # of units _____
☐ e) apartment complex - # of units _____
☐ f) highrise - # of units _____
☐ g) mobile home
☐ h) other (specify)
_____
_____

. . ./2

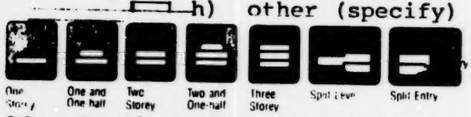
8. Type of construction:

- ☐ a) frame
- ☐ b) log
- ☐ c) masonary
- ☐ d) prefabricated



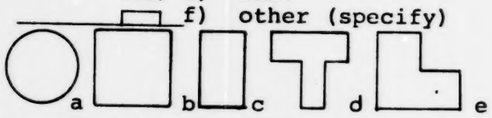
9. Number of stories

- ☐ a) one
- ☐ b) one and a half
- ☐ c) two
- ☐ d) two and a half
- ☐ e) three
- ☐ f) split-level
- ☐ g) split-entry
- ☐ h) other (specify)



10. Configuration of building:

- ☐ a) round
- ☐ b) square
- ☐ c) rectangular
- ☐ d) tee
- ☐ e) ell
- ☐ f) other (specify)



11. Foundation type:

- ☐ a) Block/skid/pile
- ☐ b) slab on grade
- ☐ c) crawl space
- ☐ d) basement/cellar

a b c d

12. Perimeter

- ☐ a) less than 25m
- ☐ b) 26-30m
- ☐ c) 31-36m
- ☐ d) 37-42m
- ☐ e) 43-48m
- ☐ f) 49-56m
- ☐ g) 57-60m
- ☐ h) 61-65m
- ☐ i) more than 66 (specify)

_____

13. Number of windows

- ☐ a) specify _____

14. Number of doors

- ☐ a) specify _____

15. Eave height

- ☐ a) specify _____

16. Thickness of walls

- ☐ a) specify _____

17. Condition of structure

- ☐ a) good
- ☐ b) fair
- ☐ c) poor

18. Type(s) of fuel used for heating:

- ☐ a) oil
- ☐ b) electricity
- ☐ c) wood
- ☐ d) propane
- ☐ e) natural gas
- ☐ f) oil and electricity
- ☐ g) electricity and wood
- ☐ h) oil and wood
- ☐ i) other combinations (specify)

_____